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Implementation of an Integrated Project Based Learning Model for Generic Science Skills in Acid-Base Material

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Abstract: *This research aims to determine the effect of Evaluation of Prior Knowledge and Student Worksheets on Evaluation of Learning Outcomes and determine the difference in learning outcomes between high initial knowledge and low initial knowledge using the Project Based Learning model integrated with Generic Science Skills in Acid-Base material. This research has two independent variables, namely Initial Knowledge Evaluation and Learner Worksheet and one dependent variable, namely Evaluation of learning outcomes data. The population in this study were all class XI students of SMA Negeri 2 Kabanjahe consisting of 6 classes. The sample in this study was taken using a purposive sampling technique from 1 class, namely class. The instruments used are initial knowledge evaluation test instruments, learning outcome evaluation test instruments and Student Worksheets as well as non-test student observation sheets. Data were analyzed using multiple linear regression tests and Independent Sample T-Test. The results of data analysis show that there is a significant influence between the value of Prior Knowledge and Student Worksheets on learning outcomes and there is a significant difference in the value of learning outcomes between students whose initial abilities are classified as high and students whose initial abilities are classified as low.*

Keywords: *project based learning; initial knowledge; learning outcomes; generic science skills; acids and bases*

INTRODUCTION

The school is one of the few forums in the field of education which has a meaningful position for personality building and competency building in each student through activities learning and other activities contained inside (Dalimunthe & Ginting, 2022)

Education is a means of expressing human culture and a prerequisite for a country's advancement. As a result, advancements or modifications in education ought to correspond with shifts in popular culture. The definition of "improving education at all levels" is always evolving to reflect changing interests (Muliaman & Mellyzar, 2020)

When compared to other nations, Indonesian education still falls into the low category. One factor that influences education quality is having good people resources since these resources are linked to Indonesia's future interactions with other countries. Indonesia

was extremely concerned when the World Economic Forum published its 2017 report based on data from the Global Human Capital Report, as Indonesia was placed 65th out of 130 nations in the area of education at the time. Indonesia falls much behind of its neighboring nations (Wahyudi et al., 2022)

According to Trianto in (Siregar & Panggabean, 2020), the main problem in the learning process is still low absorption by students. Most learning processes are still teacher-centered so that teachers do not provide access to students to develop independently. According to Abidin in, students are also familiar with the information they get from the teacher as the main resource person, so that students feeling uncomfortable with the way he learns on his own in the problem-solving process. Theoretically, a common learning challenge is students' interest in what they are studying. This challenge can be overcome by using an engaging, productive, and successful learning paradigm that exposes students to ideas and information they were not previously aware of (Ramadhana & Sutiani, 2023).

The primary issue with learning in formal education (schools) nowadays is still pupils' poor engagement. More significantly, that the educational process still favors teachers over students and is teacher-Centered preventing pupils from growing as autonomous thinkers through exploration (Sianturi & Panggabean, 2019). Based on observations, problems related to material content and teacher pedagogic abilities were found to be the difficulty of teachers making students able to construct in every step both in PJBL because so far they have not paid attention to prerequisite material, material sequential, material depth (Haryani et al., 2018). Education is undoubtedly one efficient technique to create human resources that are prepared to take on the challenges of the 21st century (Redhana, 2019).

One of the areas of natural science that deals with ideas, regulations, laws, principles, and theory is chemistry. Chemistry has several characteristics, among others: (1) most Chemical concepts are abstract, (2) Concepts chemistry in general is a simplification of circumstances actually, and (3) concepts in chemistry is sequential and develops with fast (Sutiani & Fayaddah, 2021).

Chemistry is a subject in high school that is often considered difficult by some students, this is because the material in chemistry subjects includes abstract things, memorization and also calculations so that students find it difficult to understand the material. Most students find it difficult to understand and also apply many formulas during chemistry learning (Sudiana et al., 2019). Natural knowledge manifests itself in chemistry courses as facts, theories, principles, and rules governing scientific methodology. Therefore, three elements must be included in the application of chemistry learning: products, procedures, and scientific attitudes (Dibyantini & Azaria, 2020). Students often perceive chemistry as a challenging subject due to its abstract and complex concepts (Marsita & Kusuma, 2010). Science's study of items' properties, composition, structure, and changes brought about by interactions with other objects a process known as chemical reactions is known as chemistry (Situmorang et al., 2023).

One of the chemicals of SMA is Acid Base. Acid-base is the subject matter which is the basic concept to understand the higher concepts of buffer solution and salt hydrolysis. But according to students, acid-base solutions are difficult to understand

According to research (Tarhan & Sesen, 2012). Student’s difficulties in acid-base material are ascribed to many misconceptions related to the concepts of knowledge of acid base solution chemical concepts, causing student learning outcomes on acid-base material to be low.

Based on the findings of actual observations made by researchers at SMAN 2 Kabanjahe of the instructor and a number of class XI attendees, data was obtained that the presentation of acid-base material carried out

by the teacher is still monotonous, because it still uses the lecture method and records the material in the teaching material book and teaching materials used by the teacher are less attractive to students so that students get bored quickly during the learning process, so that causing student learning outcomes to be still low, students also do not have initial knowledge that is integrated with good generic science skills before learning chemistry, one of which is acid-base material so that students cannot work on questions based on High Order Thinking Skill (HOTS). Based on The Results of Observations. Initial ability is one of the internal factors that affect student learning achievement and is seen as a relevant skill that is possessed when starting to follow a lesson so that it can be said that initial ability is a prerequisite that students must master before participating in a learning activity. The Prior Knowledge Evaluation intended in this research aims to measure students initial abilities before learning begins (Silitonga et al., 2022).

Curriculum is always connected to education. It is possible to say that the curriculum serves as a guide for the process of implementing education in Indonesia because it is a tool utilized to accomplish educational goals (Angga et al., 2022). curriculum indicates the foundation or perspective on life that education is based on. This undoubtedly demonstrates the learning objectives that must be met in the classroom. The curriculum was developed with the intention of making learning more straightforward.

Teachers can employ a variety of learning methods, including Project Based Learning (PJBL), Problem Based Learning (PBL), Inquiry Learning, and Discovery Learning (DL), as outlined in the 2013 curriculum or in other curriculums. During the educational process, the appropriate model selection and application can aid students in comprehending the content that the instructor is delivering, leading to improvements in student learning outcomes. Generic science skills that are one result of From students' thinking skills can be seen the relationship with students' cognitive learning outcomes (Abdullah, 2017).

Project-Based Learning (PJBL) is a cutting-edge approach to education in which teachers serve primarily as facilitators and students receive more attention (Rahayu et al., 2017). The PJBL learning paradigm helps students develop better study habits and is a good way to inspire them to use critical thinking to address real-world problems. In a learning project, the instructor plays the role of a facilitator, working with students to provide relevant assignments and questions that will help them develop their social and intellectual abilities as well as evaluate their progress. PJBL can also help students become more adept at using their creative thinking.

A learning paradigm that alludes to constructivism is the project-based learning model. Through projects undertaken by participants Educate, indirectly student activities Educate Increased Because They Are Free apply knowledge and skills they have (Purba & Siregar, 2020).

The PJBL model can be the right choice among other learning models in the 2013 Curriculum, because this learning model aims to develop students' thinking skills through joint problem solving (collaboration). The role of the teacher is more to establish themselves as a mentor or learning leader and learning facilitator. Thus, students do more activities alone or in groups to solve problems with teacher guidance.

During the learning process, learners must also be actively involved which is able to improve Science Generic Skills, Science Generic Skills is a basic skill that can be developed through chemistry learning. This skill is needed by students as a provision to learn the concepts contained in chemistry learning at a higher level. Science Generic Skills that can be developed through chemistry learning, include: 1) Firsthand observation 2) By indirect observation; 3) knowledge of scale; 4) symbolic language; 5) logical frame; 6) logical consistency; 7) cause

and effect law; 8) modeling; 9) logical inference; and 10) construct a notion.

Class XI IPA SMA Negeri 2 Tondano students' learning outcomes can be improved by 22.23% in terms of completeness when the PJBL model is applied to acid-base content, according to research conducted by (Siburian et al., 2021).

Based on the development of learning tools that have been carried out by Mutiara Hani Tambunan, Hanna Maria Siahaan, in this research will be carried out the implementation of learning tools that have been developed as for the learning tools including Initial Knowledge Evaluation Test Instruments, Teaching Materials, Student Worksheets, and Student Learning Outcome Evaluation Question Instruments.

Based on the background above, researchers will conduct research entitled "Implementation of an Integrated Project Based Learning Model for Science Generic Skills in Acid-Base Material".

METHODS

A dual paradigm was used in the research design. The complete class XI of SMAN 2 Kabanjahe served as the study's population, and class XI MIPA 2 served as the study's sample. Purposive sampling methods are used in the sampling process. Twenty initial knowledge evaluation questions, twenty multiple-choice questions developed by earlier researchers to evaluate learning outcomes, and up to ten descriptors from student and teacher observation sheets made up the non-test instruments used in this study.

The learner worksheet, the evaluation of learning outcomes, and the initial knowledge evaluation are the data collected for this study. Three tests of statistical analysis are used: the homogeneity, normality, and hypothesis tests. To find out if the data has a normal distribution or not, a normality test is run. The Shapiro Wilk test was employed by the researchers as a normality test with SPSS 25.0 for Windows at a significance level of 5%. Finding out if the data is homogeneous is the goal of the homogeneity test. The Levene test is a homogeneity test that researchers utilize. To ascertain whether there is a difference in learning outcomes between low and high Initial Knowledge Evaluation, as well as whether there is a significant relationship between Initial Knowledge Evaluation and Learner Worksheet, hypothesis testing is done. Researchers utilize Independent Sample t-tests and multiple linear regression tests to test their hypotheses.

RESULTS AND DISCUSSION

A. RESULT

1. Description of Research Data

Based on research that has been done, the average Initial Knowledge Evaluation, Learner Worksheet and Evaluation of learning outcomes data obtained can be seen in table 1.

Table 1. Average initial knowledge evaluation, learner worksheet and evaluation of learning outcomes data

Score	Meet 1	Meet 2	Meet 3
Initial Knowledge Evaluation	76.66	83.94	73.19
Learner Worksheet	78.88	86.66	74.44
Evaluation of learning outcomes data	82.58	87.5	81.72

Based on the data in table 4.1, data on Initial Knowledge Evaluation, Learner Worksheet, and Evaluation of learning outcomes data values were obtained during the study. At the first meeting the lowest Initial Knowledge Evaluation score was 60 and the highest score was 100. At the second meeting the lowest Initial Knowledge Evaluation value was 66 and the highest value was 100. In the third meeting, the lowest Initial Knowledge Evaluation score was 50 and the highest score was 92. The average Initial Knowledge Evaluation scores at the first meeting to the fourth meeting were 76.66; 83.94; 73.19 respectively. Then for the Learner Worksheet results at the first meeting the lowest Learner Worksheet score was 60 and the highest score was 100. At the second meeting the lowest Learner Worksheet score

was 60 and the highest score was 100. The average value of Learner Worksheet at the first meeting to the fourth meeting was 78.88; 86.66; 74.44. And the Evaluation of learning outcomes data score at the first meeting the lowest Evaluation of learning outcomes data score was 67 and the highest score was 100. At the second meeting the lowest Evaluation of learning outcomes data score was 50 and the highest score was 100. At the third meeting the lowest Evaluation of learning outcomes data score was 43 and the highest score was 100. The average Evaluation of learning outcomes data scores at the first meeting to the fourth meeting were 82.58; 87.5; 81.72.

2. Normality and Homogenety Test

The SPSS 25.0 software is used to conduct tests for homogeneity and normalcy, two data prerequisites. at a 5% level of significance (sig.0.05). The Shapiro-Wilk test is the normalcy test that is employed. if sig. > 0.05 and the study is regularly distributed. Table 2 below contains information on the outcomes of the normalcy test.

Table 2. Normality test results

Source	Shapiro-Wilk Sig	Information
Initial knowledge evaluation	0.128	Normal Data
Learner worksheets	0.059	Normal Data
Evaluation of learning outcomes data	0.062	Normal Data

It is evident from the above normalcy test findings that there is an increase in significant values of 0.128 for each of the values 0.059 and 0.062. This indicates that both data sets are bigger than 0.05 (sig.>0.05), indicating that a normal distribution can be applied to them.

Additionally, once the data had been distributed normally, homogeneity tests were performed using the Levene test and the SPSS program version 25.0 on the Initial Knowledge Evaluation, Learner Worksheet, and Evaluation of Learning Outcomes data of the students. If α (0.05) is greater than the significance value, the data is considered homogenous.

Table 3. Homogeneity test results

Source	Levene Test Sig	Information
Initial knowledge evaluation	0.813	Homogeneous
Learner worksheets	0.829	Homogeneous
Evaluation of learning outcomes data	0.812	Homogeneous

Based on the data processing results of the homogeneity test, the initial knowledge evaluation, learner worksheet, and learning outcomes data are homogeneous, as indicated by the significance values of 0.813, 0.829, and 0.812 that were obtained. These results suggest that the homogeneous test has a significance value greater than α (0.05).

3. Data analysis

To address the phrasing of the problem, a hypothesis test can be performed once it is shown that the data is homogeneous and regularly distributed. The Independent Sample T-assess and linear regression tests were used to assess the hypotheses at a significance level of 5% (sig.0.05) using the SPSS software version 25.0.

3.1 Multiple Linear Regression Test

To find out if the learner worksheet and the first knowledge evaluation had a substantial impact on learning results, multiple linear regression tests were run.

a. Partial t-test

The learner worksheet and initial knowledge evaluation both have significant values of 0.016 and 0.002, respectively, less than 0.05, according to the data processing results. Thus, it can be said that H0 is rejected while Ha is accepted. This indicates that learning outcomes are somewhat influenced by the learner worksheet and the initial knowledge evaluation.

b. F test

When a significant value of 0.000 < 0.05 is achieved in the F test, H0 is rejected and Ha is allowed if the sig value < a (0.05). Thus, the characteristics of the learner worksheet and the initial knowledge evaluation combined influence learning outcomes.

c. R^2 Test

The initial knowledge evaluation and learner worksheet have an 81.6% influence on the dependent variable, learning outcomes, according to the regression/influence value (R) of 0.903 and the coefficient of determination (R square) of 0.816. The remaining 18.4% of the data is influenced by other variables.

3.2 Independent Sample T-Test

Additionally, the data were examined using the SPSS program version 25.0 and the Independent Sample t-Test hypothesis test. Learning outcomes are given sig values based on how the data from the hypothesis test is processed. Given that the 2-tailed value is 0.000 > 0.005, it may be concluded that students with high initial knowledge and those with low early knowledge have different learning outcomes.

B. DISCUSSION

The findings are consistent with a study (Lestari, 2017). found that beginning abilities have an impact on students' learning outcomes. Specifically, students with high initial knowledge tend to have high learning outcomes, while those with low initial abilities may have poor learning outcomes. because they are still unable to use their understanding of the fundamentals as a guide when studying new content.

Moreover, the Independent Sample T-test has a significance value of 0.00. A significance value less than 0.05 is displayed in the result (sig value < α (0.05)). Therefore, it can be said that there is a distinction in the assessment of learning outcomes between students who receive a high initial knowledge evaluation and those who receive a low initial knowledge evaluation.

Because it uses the integrated PJBL learning model of Science Generic Skills to improve student learning results, this research can be considered important. The results of low Initial Knowledge Evaluation scores, low Learner Worksheet scores, and low learning outcomes scores show that even though the completion rate of students is not 100%, there are still some students whose learning preparation is still deficient. This occurs as a result of additional external and internal influences, including motivation, interest, and surroundings. Additionally, student observation papers provide evidence of how engaged kids are in the learning process and how comprehensive their values are.

CONCLUSION

The evaluation of learning outcomes is significantly influenced, partially and concurrently, by the learner worksheet and the initial knowledge evaluation, according to the results of data processing and hypothesis testing. Initial Knowledge Evaluation and Learner Worksheet have an 81.6% influence on the evaluation of learning outcomes, while other variables which can stem from both internal (motivation to learn) and external (family, school, social environment, and economic circumstances) factors have an 18.4% influence. Pupils with low Initial Knowledge Evaluation and pupils with high Initial Knowledge Evaluation have different learning outcomes.

When students begin with high abilities, they end up with good learning outcomes; when they start off with low abilities, they end up with low learning outcomes. The findings of this study can serve as a guide for future researchers conducting related studies using alternative materials. They can also be utilized to enhance students' knowledge and skills and ensure that they are well-prepared, both in terms of tools and themselves.

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